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ELEMENTAL ABUNDANCES IN THE INTRACLUSTER GAS AND THE HOT GALACTIC CORONAE IN CLUSTER A194

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Performance Report

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The work supported on this grant covers three proposals - 1) a study of the elemental abundances in the intra-cluster gas and the hot galactic coronae in A194, 2) an investigation of the massive cooling flow cluster A2597, and 3) a study of merging in clusters of galaxies. The status and progress on these investigations is described below.

A194 is a unique cluster because of its very high fraction of early-type galaxies (E and S0) and yet its remarkably low X-ray luminosity and cool temperature. We have completed a preliminary analysis of this cluster. In addition, we have endeavored to combine the ROSAT and ASCA data by a new analysis of the ROSAT data. We have generated abundance (and temperature maps) by identifying energy bands which are particularly sensitive to the heavy element abundances. Using these bands, we have calculated maps of the heavy element abundance throughout the cluster.

For the cluster studies (topics 2 and 3), we have published one paper and are preparing a second on the analysis of ASCA data. The first paper, "Mapping the Gas Temperature Distribution in Extended X-ray Sources and Spectral Analysis in the Case of Low Statistics – Application to ASCA Observations of Clusters of Galaxies" is in press for the Astrophysical Journal. In this paper we described a technique to generate continuous temperature maps of clusters of galaxies which overcomes the biases inherent in fitting data with relatively few counts and spectral resolution typical of ASCA. We show that spectral parameters can be determined from the coefficients of a linear combination of two spectra which bound the expected range of cluster temperatures in the target cluster. This linear process is very rapid and permits the calculation of spectral parameters with errors on fine spatial scales. Furthermore, we showed that using the smoothed data as the weighting for standard fitting provides unbiased temperature determinations even when there are very few counts for each spectral analysis. This new weighting scheme has been incorporated into the GSFC-supplied spectral fitting program XSPEC.

Second, we are preparing a paper describing the technique to compute spectra for ASCA observations of extended sources which properly accounts for the broad energy dependent wings of the ASCA telescope PSF. This paper shows that using Monte Carlo simulations one can generate continuous

temperature maps (using the linear approximation described above) while at the same time removing the effects of the bright cluster core on the faint cluster outskirts.

We have begun the application of the above techniques to several clusters to demonstrate the correctness and accuracy of the new approach. For A3528, we have carried out the screening for both GIS and SIS and generated smoothed temperature maps of the two components. We plan to apply the method fully to the other cluster, SC0559 and A2597 as a guide to detailed spectral fitting to map temperature profiles and look for indications of merging effects.